

Federal and state regulations require developers to design sediment and turbidity control programs for construction sites (USEPA, 1992; NC DEHNR, 1995). In an effort to reduce the sediment coming from construction activities, North Carolina enacted the Sedimentation Pollution Control act of 1973. This act requires that any land disturbing activity that covers one or more acres must have an approved erosion and sedimentation control plan. Further, the plan must include structural or non-structural management practices that reduce non-point source inputs to receiving waters, sufficient enough to prevent off-site sedimentation damage (NCDENR, 2004). In addition to this regulation, North Carolina Administrative Code 15A NCAC 02B .0211 states that the turbidity in the receiving waters adjacent to a site must not exceed 50 nephelometric turbidity units (NTU) in streams not designated as trout waters, and 10 NTU in water bodies designated as trout waters. If the receiving water already exceeds these levels, runoff from a construction site cannot increase turbidity further. However, the existing control measures are usually ineffective in reducing the elevated levels of turbidity in the waters discharged from the construction sites.

Turbidities of waters discharged from construction sites range from hundreds to thousands of NTU. Przepiora et al. (1997) observed turbidities of 120 to 3200 NTU from two construction sites during a one year period. Suspended clay and fine silt particles escape detention by the standard control structures due to their low settling velocities (Haan et al., 1994; Wu et al., 1996), regardless of particle shape (Simons and Senturk, 1992) unless residence time is increased or aggregation is induced by natural or artificial means (Chen, 1975). Line and White (2001) found the trapping efficiency of sediment traps located on an active construction site in North Carolina to range from 59 to 69%, with retention of only 43 per cent of the silt and 21 per cent of the clay sized particles. Consequently, fine sediment resulted in turbidity ranging from 100 – 15,000 NTU in the discharged water. Stilling basins are impoundments used on construction sites to settle suspended solids in turbid water being pumped from excavations. Baffles of various designs can be installed within the basin to dissipate flow energy and lengthen the flow path, providing suspended particles an increased opportunity to settle. Turbulence within the water column contributes to prolonged suspension (Graf, 1971; Goldman et al., 1986). Baffles installed in a pond increase sediment retention rates by reducing the flow energy and turbulence within the pond and increasing the hydraulically effective width defined by Chen (1975) as “the width over which the flow is uniformly distributed”. Jarrett (1996) and Millen et al (1997) found that geotextile baffles reduce short circuiting and thus increase trapping effectiveness, although in an undersized pond baffles may not significantly improve total sediment capture (Rauhofer et al., 2001). In an evaluation of geo-textiles for sediment control, Barrett et al. (1998) concluded that sediment removal from highway construction sites was due to the formation of pools that formed behind the silt fabric fence and not by filtration by the geotextile material. Porous baffles have been found to be very effective at absorbing the inflow momentum, reducing turbulent energy and diffusing the incoming energy and flow velocity such that more of the pond volume participates in the sediment settling process (Thaxton et al., 2004). Evidence of an optimal open space fraction (OSF, area occupied by open pores divided by total area) of 5-10% was suggested by Thaxton et al. (2004) but not investigated further. Though the porous baffles increase the retention of coarser sediment, fine suspended sediment remain largely uncaptured (Thaxton and McLaughlin, 2005). Due to the size and nature of the suspended particles, the decrease in turbulence does not have significant effects on their settling (Holliday et al., 2003), especially without chemical treatment for flocculation.